California Environmental Protection Agency

Air Resources Board

Vapor Recovery Test Procedure

TP-201.1C

~~Pressure Integrity~~ Leak Rate of Drop Tube/Drain Valve Assembly

Adopted: July 3, 2002
Amended: October 8, 2003

Note: The text is shown in ~~strikeout~~ to indicate text that is proposed for deletion and underline to indicate text that is proposed for addition. [Bracketed text] is not part of the proposed amendments.

California Environmental Protection Agency
Air Resources Board

Vapor Recovery Test Procedure

TP-201.1C

~~Pressure Integrity~~ Leak Rate of Drop Tube/Drain Valve Assembly

Definitions common to all certification and test procedures are in:

D-200 Definitions for Vapor Recovery Procedures

For the purpose of this procedure, the term "CARB" refers to the California Air Resources Board, and the term "Executive Officer" refers to the CARB Executive Officer, or his or her authorized representative or designate.

1. PURPOSE AND APPLICABILITY

~~1.1~~ The purpose of this procedure is to quantify the ~~pressure integrity~~ leak rate of ~~both~~ a ~~drop tube and drain valve seal~~ drop tube/drain valve assembly when the ~~a drop tube is installed below a spill containment bucket on a two-point Phase I system~~ spill container drain valve is configured to pass liquid into the drop tube as shown in Figure 1. ~~This procedure is used during certification and to determine compliance of equipment at installed at gasoline dispensing facilities with the performance specification for the maximum allowable leakrate as defined in the Certification Procedure CP-201.~~ It is used to certify and to determine the compliance of components with the performance specification for the maximum allowable leak rate as defined in CP-201 Vapor Recovery Certification Procedure for Gasoline Dispensing Facilities.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

~~2.1~~ ~~A compatible product cap is modified to allow the introduction of nitrogen into a Phase I drop tube. A pressure-measuring device is connected to the modified cap. If the resulting measured nitrogen flowrate necessary to maintain a steady-state pressure of 2.00 inches H_2O is less than, or equal to, the maximum allowable leakrate the Drop Tube/Drain Valve Assembly is verified to be in compliance.~~

~~2.2~~ ~~If the introduction of nitrogen, at a flowrate equal to the maximum allowable leakrate does not result in a steady state pressure that meets, or exceeds, the limits specified in CP-201, the Phase I product adaptor shall be inspected and tested. Any leaks attributable to the Phase I product adaptor shall be corrected and the test repeated to ensure the measured pressure versus flowrate is attributable only to the Drop Tube/Drain Valve Assembly.~~ A compatible dust cap for a Phase I product adaptor is modified to allow the introduction of nitrogen into the Phase I drop tube. A pressure gauge is connected to the modified cap and nitrogen is flowed into the drop tube. If the resulting nitrogen flow rate necessary to maintain a steady-state pressure is less than or equal to the specifications described in CP-201, the drop tube/drain valve

assembly is verified to be in compliance. An inflatable bladder is installed in the Phase I drop tube below the spill container drain valve path to eliminate potential biases resulting from the level of fuel in the storage tank.

3. BIASES AND INTERFERENCES

3.1 Missing or defective gaskets on the Phase I product adaptor~~,~~ or a loose adaptor~~,~~ may bias the results towards noncompliance. ~~This bias is eliminated by testing the Phase I product adaptor for leaks prior~~ Prior to a final determination of ~~the~~ noncompliance of the component(s), ~~status of the Drop Tube/Drain Valve Assembly.~~ use leak detection solution on all visible components to verify the absence of leaks.

~~**3.2** Refueling during the test may bias the results. No vehicle refueling or bulk deliveries to any of the tanks at the facility shall occur during this test.~~

~~**3.3** Product levels less than four (4) inches above the highest opening at the bottom of the submerged drop tube may bias the test toward noncompliance.~~

3.4~~2~~ Leaks in the test equipment will bias the results toward noncompliance. Prior to conducting the test, this bias is eliminated by conducting a leak check of the test equipment~~ leak detection solution may also be used during the test~~ to verify the ~~absence of leaks in the test equipment~~. Leak detection solution may also be used during the test to verify the absence of leaks in the test equipment.

~~**Figure 1**~~
~~**Pressure Introduction Assembly**~~

[Original Figure 1, Pressure Introduction Assembly, is proposed to follow subsection 5.8 and is proposed to be re-titled as Figure 2 ~~Drop Tube~~ Leak Rate Test Assembly]

~~**3.5** Use of this procedure to quantify the leak rate of containment box drain valves that drain liquid into the ullage of the storage tank, rather than into the drop tube, will yield invalid results.~~

4. SENSITIVITY, RANGE, AND PRECISION

~~**4.1** The measurable leakrate is dependent upon the range of the flowmeter used for the test. The recommended flowmeter range specified in Section 5.1 provides sufficient precision at the maximum allowable leakrate defined in CP-201.~~

~~**4.2** The sensitivity of the pressure measuring device is 0.01 inches H_2O for electronic pressure measuring devices and 0.05 inches H_2O for mechanical pressure gauges~~.

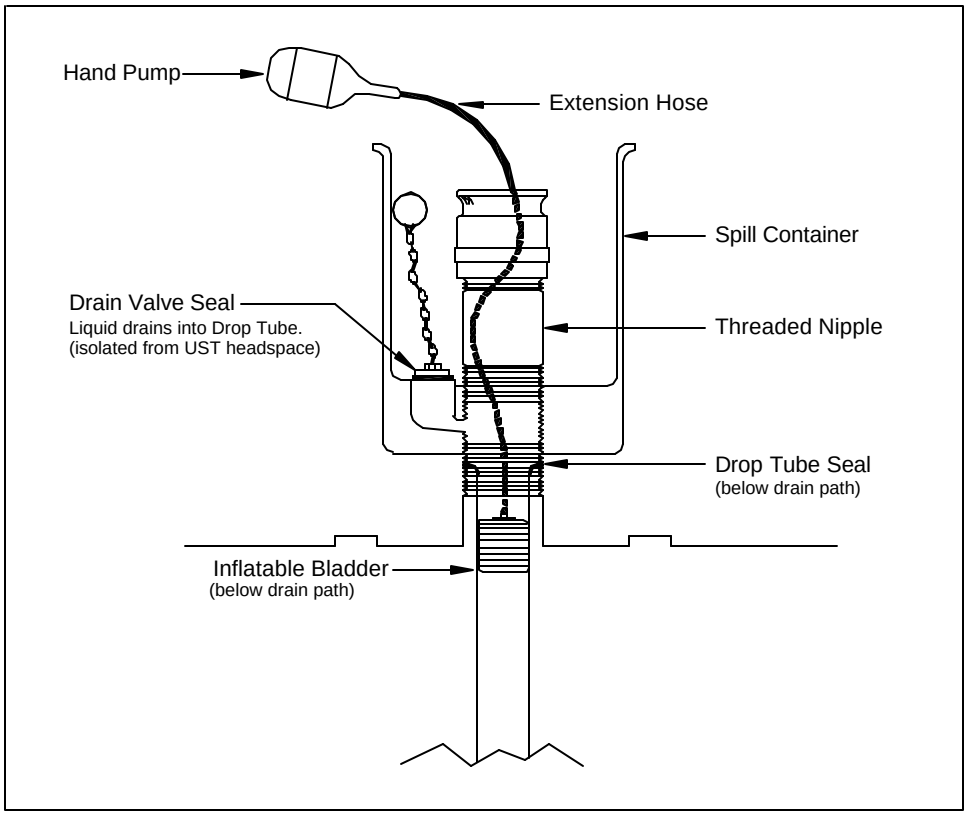
4.1 Flow Meter. The measurable leak rate is dependent upon the sensitivity, range and precision of the flow meter used for testing. The flow meter minimum sensitivity shall be 12.5 ml/min (.026 CFH) with minimum accuracy of ± 5 percent full-scale. The device scale shall be 150mm (5.91 inches) tall to provide a sufficient number of graduations for readability. For electronic flow metering devices, the minimum sensitivity shall be 1.0 ml/min (0.0021 CFH) with a minimum full-scale accuracy of ±1.0 percent.

4.2 Pressure Gauge. The measurable pressure is dependent upon the sensitivity, range and precision of the pressure gauge used for testing. For mechanical pressure gauges, the maximum pressure range shall be 0-4 inches H_2O. The minimum full-scale accuracy shall be ± 3.0 percent and the gauge shall be readable to the nearest 0.10 inches H_2O. For electronic pressure gauges, the maximum pressure range of the device shall be –10 to 10 inches H_2O. The minimum full accuracy shall be ± 1.5 percent of full-scale range and the pressure gauge shall be readable to the nearest 0.01 inches H_2O.

~~**Figure 2**~~
~~**Product Cap Test Assembly**~~

[Figure 2 is proposed to be relocated following subsection 6.3 and renamed to Figure 3 ~~Drop Tube~~ Product Adaptor Test Cap]

Figure 1
Typical Inflatable Bladder Installation



5. EQUIPMENT

~~**5.1** Pressure Introduction Assembly. Use a product cap compatible with the Phase I product adaptor. The cap shall be equipped with a pressure tap and flowmeter capable of measuring flowrates equal to the maximum allowable leakrate. The maximum allowable full-scale range for the flowmeter shall be 1.00 CFH. The~~

~~flowmeter shall be calibrated for use with nitrogen. As a safety precaution, the hose used to feed nitrogen into the assembly shall be steel braided, or a separate grounding strap may be used. An example of a complete Pressure Introduction Assembly is shown in Figure 1. An example of a Product Cap Test Assembly is shown in Figure 2.~~

~~**5.2** Pressure Measuring Device. Use a pressure-measuring device to monitor the pressure in the drop tube~~.

~~5.2.1 If an electronic pressure-measuring device is used, the maximum full scale range of the device shall be 10 inches H_2O. The minimum accuracy shall be 0.5 percent and the pressure measuring device shall be readable to the nearest 0.01 inches H_2O.~~

~~5.2.2 If a mechanical pressure-measuring device is used, the maximum fullscale range shall be 5 inches H_2O. The minimum accuracy shall be 1.0 percent and the minimum graduations shall be 0.05 inches H_2O. The minimum diameter of the pressure gauge face shall be 4 inches.~~

~~**Figure 3**~~
~~**Vapor Poppet Pressure Relief Assembly**~~ [Figure removed]

5.1 Pressure Gauge. Use a pressure gauge with minimum specifications listed in Section 4 to monitor the pressure in the drop tube.

5.2 Flow Meter. Use a flow meter with minimum specifications listed in Section 4 to set the required nitrogen flow rate(s).

5.3 Nitrogen. Use commercial grade gaseous nitrogen in a high-pressure cylinder, equipped with a ~~two-stage~~ pressure regulator and a one psig pressure relief valve.

5.4 Stopwatch. Use a stopwatch accurate to within ~~0.2~~ 0.10 seconds to time the ~~duration of the test~~ pressurization of the drop tube and pressure stabilization period .

5.5 Leak Detection Solution. Any non-flammable commercial liquid solution designed to detect vapor leaks may be used ~~to verify the pressure integrity of the Phase I product adaptor during this test~~.

~~**5.6** Vapor Poppet Pressure Relief Assembly. Use an assembly to open the Phase I vapor poppet during testing. This will ensure that the underground storage tank (UST) ullage and liquid surface is at zero gauge pressure. An example of a Vapor Poppet Pressure Relief Assembly is shown in Figure 3.~~

~~**5.7** Traffic Cones. Use traffic cones to encircle the area containing the Phase I spill containment buckets while the test is being conducted.~~

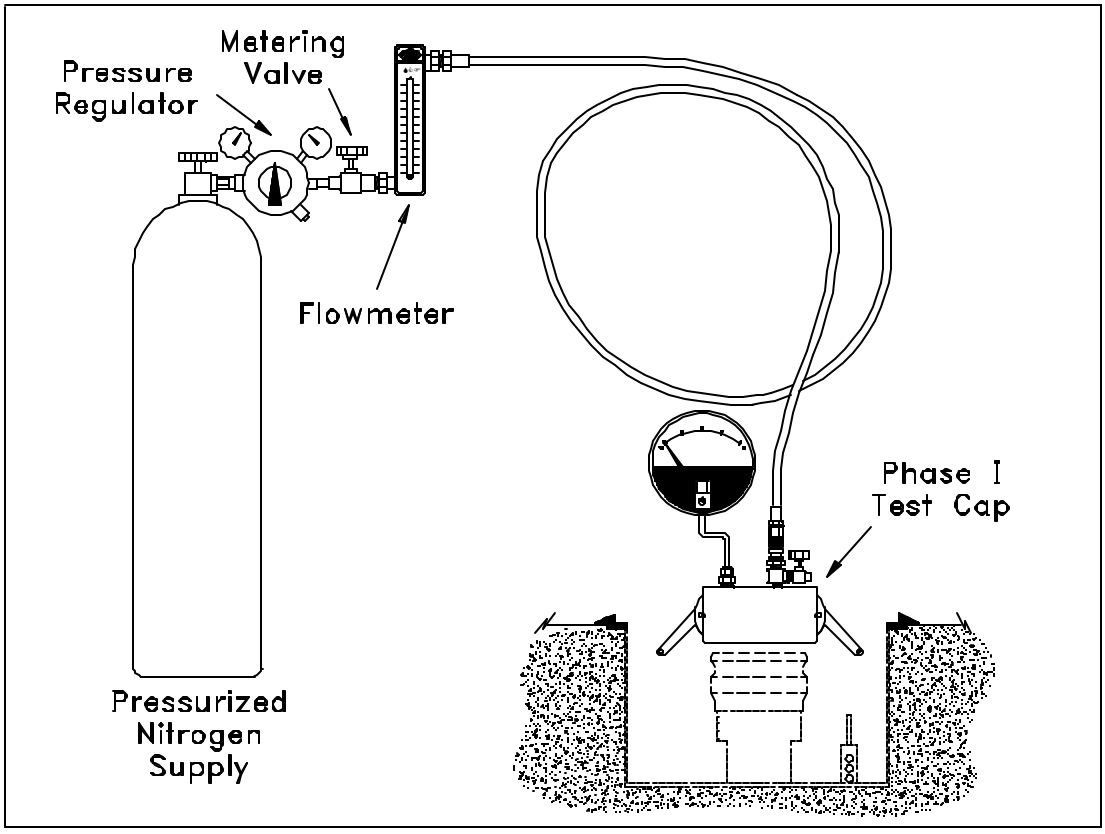
~~**5.8** Tank Gauging Stick. Use a tank gauging stick of sufficient length to verify that the UST liquid level is at least four (4) inches above the highest opening at the bottom of~~

~~the submerged drop tube. The tank gauging stick shall be equipped with a non-sparking "L" bracket at the end.~~

5.6 Inflatable bladder. Use an inflatable bladder and extension hose, as shown in Figure 1, to isolate the drain valve. Unless otherwise specified in the certification Executive Order for the system, a "3-4 model" inflatable plumber's bladder may be used.

5.7 Product Adaptor Test Cap. Use a modified product dust cap compatible with the Phase I product adaptor. The cap shall be equipped with connections for a pressure gauge and flow meter. An optional metering valve may be installed to relieve excess pressure. An example of a Product Adaptor Test Cap is shown in Figure 3.

~~**Figure 4**~~
~~**Drain Valve Configured to Drain into Drop Tube**~~ [Renamed Figure 2 to replace Figure 4]
Figure 2
Leak Rate Test Assembly



6. PRE-TEST PROCEDURES

6.1 The flow meter and pressure gauge ~~pressure-measuring device~~ shall be calibrated within ~~the 180 days~~ six (6) months prior to conducting the testing. The flow meter(s)

shall be calibrated for use with nitrogen. Calibrations shall be conducted in accordance with EPA or CARB protocols. CARB calibration methodology for flow meters and pressure gauges ~~are~~ is contained in Appendix D of Air Monitoring Quality Assurance, Volume VI, Standard Operating Procedures for Stationary Source Emission Monitoring and Testing, January 1979.

~~**6.2** Place the traffic cones around the perimeter of the Phase I spill containment buckets, allowing sufficient space to safely conduct the test.~~

6.3~~2~~ Remove the lids ~~of the Phase I~~ from the spill ~~containment buckets~~ containers and inspect the drain valve configuration. ~~Visually determine that the drop tube is installed below the spill containment bucket and that the drain path allows liquid to drain directly into the drop tube.~~ Verify that the drain valve passes liquid directly into the drop tube, as shown in Figure 1, rather than into the storage tank ullage space.

~~**6.4** Inspect the Phase I product adaptor to ensure that the gasket is intact and that the adaptor is securely attached to the Phase I product stem.~~

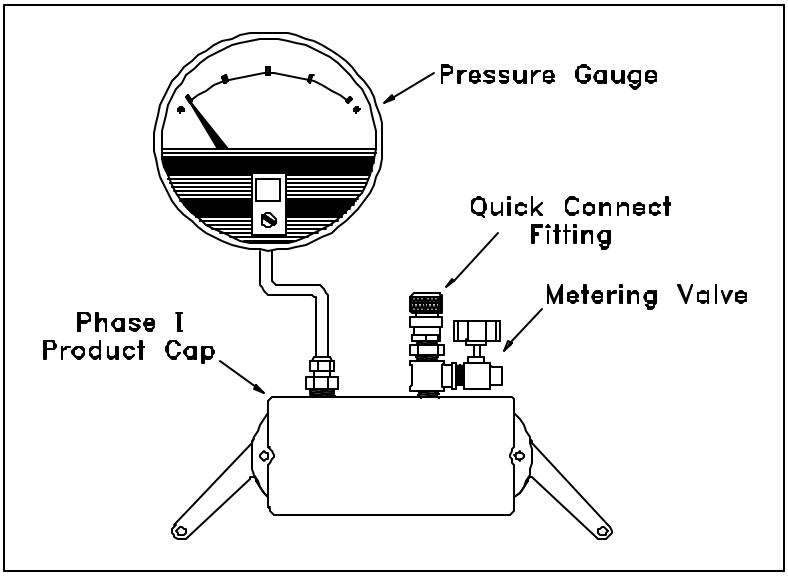
~~**6.5** Verify that the liquid level in the storage tank is at least four (4) inches above the highest opening at the bottom of the submerged drop tube using the tank gauging stick.~~

~~**6.6** Inspect the drain valve configuration. Verify that the drain valve drains liquid directly into the drop tube above the Overfill Prevention device, as shown in Figure 4, rather than into the underground storage tank ullage space. If the drain valve drains into the underground tank ullage space, this procedure will only quantify the leak rate through the connections.~~

6.3 Inspect the Phase I product adaptor to ensure that the gasket is installed and that the adaptor is securely attached to the Phase I product riser.

[Add Figure]

Figure 3
Product Adaptor Test Cap



7. TEST PROCEDURE

7.1 Connect the Pressure Introduction Assembly to the Phase I product drop tube as shown in Figure 1. Connect the nitrogen supply line to the inlet of the flowmeter.

7.2 Connect the Vapor Poppet Pressure Relief Assembly to the Phase I vapor poppet to bring the UST headspace to atmospheric pressure.

7.3 With no vehicle refueling occurring, open the nitrogen supply and adjust the nitrogen flowrate to at least three times the maximum allowable leakrate specified in CP-201, and start the stopwatch.

7.4 Wait until the pressure measuring device records a pressure between 2.00 and 2.20 inches H_2O.

7.4.1 If the pressure does not reach at least 2.00 inches H_2O within 180 seconds, the Drop Tube/Drain Valve Assembly does not comply with the maximum allowable leakrate.

7.4.2 If the pressure reaches at least 2.00 inches H_2O, reduce the introduction of nitrogen to the allowable leakrate specified in CP-201. Wait until the pressure reaches steady state conditions for at least ten (10) seconds and record both the nitrogen flowrate and the steady state pressure. If the steady state pressure is less than 2.00 inches H_2O, the Drop Tube/Drain Valve Assembly does not comply with the maximum allowable leakrate.

~~7.4.3 If the Drop Tube/Drain Valve Assembly does not reach the minimum specified pressure, use a soap solution on the rotatable adaptor to check for leaks at the rotation mechanism or the adaptor seal.~~

7.1 Carefully install the inflatable bladder into the drop tube as shown in Figure 1 and inflate.

7.2 Connect the Product Adaptor Test Cap to the Phase I product adaptor and connect the flow meter and pressure gauge to the test cap as shown in Figure 2.

7.3 Open the nitrogen supply and adjust the nitrogen flow to a rate no greater than the maximum allowable leak rate specified for the drain valve in CP-201 and start the stopwatch for a maximum of 5 minutes.

7.4 Wait until the pressure gauge indicates a pressure equal to the performance specification pressure for the drain valve as defined in CP-201.

7.4.1 If the pressure gauge does not indicate the specified pressure within 5 minutes, the drain valve does not comply with the maximum allowable leak rate specification.

7.4.2 If the pressure gauge indicates the specified pressure within 5 minutes immediately reduce the nitrogen flow in order to stabilize at the specified pressure (±0.05 inches H_2O) for 30 seconds.

7.5 Record the flow rate required to stabilize at the pressure specified in CP-201.

7.5.1 If the final flow rate is below the detectable limit of the flow meter, record the lowest measurable flow rate and final pressure on the data sheet.

7.5.2 If the final flow rate is greater than the capacity of the flow meter, record the highest measurable flow rate and final pressure.

8. POST-TEST PROCEDURES

~~**8.1** Remove the Pressure Introduction Assembly and the Vapor Poppet Pressure Relief Assembly from the Phase I connections. Replace the caps on the appropriate Phase I adaptors, and the lids on the appropriate spill containment buckets.~~

~~**8.2** Remove the traffic cones from the Phase I area.~~

~~**8.3** If the steady-state pressure, at a nitrogen flowrate rate equal to the allowable leakrate, was not equal to or greater than 2.00 inches H_2O, Equation 9-1 may be used to determine the leakrate at 2.00 inches H_2O.~~

8.1 Carefully remove the Product Adaptor Test Assembly and the Inflatable Bladder from the Phase I drop tube.

8.2 Replace the caps on the appropriate Phase I adaptors, and the appropriate lids on the spill containers.

9. CALCULATING RESULTS

9.1 If the flow rate of ~~N~~nitrogen was at the upper limit of the flow meter and the measured pressure never reached ~~2.00 inches $H_2$0~~ the specified pressure, but was greater than 0.0 inches H_2O, the actual leak rate at a specified pressure ~~of 2.00 inches H_2O~~ shall be calculated as follows:

$$Q_{2.00} = (2.00)^{1/2}\left[\frac{Q_{actual}}{(P_{actual})^{1/2}}\right]$$ ~~Equation 9 – 1~~ [delete equation]

$$Q_{SP} = (SP)^{1/2}\left[\frac{Q_{actual}}{(P_{actual})^{1/2}}\right]$$ Equation 9 – 1 [adopt equation]

Where:

$Q_{2.00SP}$ = The leak rate of the ~~drop tube assembly at 2.00 inches H_2O~~ component at the specified pressure, cubic feet per hour
Q_{actual} = The actual ~~introduction~~ flow rate of nitrogen, cubic feet per hour
P_{actual} = The actual measured steady-state pressure at Q_{actual}, inches H_2O
~~2.00~~SP = Specified Pressure, defined in CP-201, inches H_2O

9.2 Commonly used flow rate conversions:

1 CFH = 471.95 ml/min

Example: Convert 0.17 CFH to ml/min: 0.17 CFH x 471.95 = 80 ml/min

1 ml/min = 0.00212 CFH

Example: Convert 100 ml/min to CFH: 100 ml/min x 0.00212 = 0.21 CFH

Commonly Used Flow Rate Conversions	
0.05 CFH = 24 ml/min	0.21 CFH = 100 ml/min
0.17 CFH = 80 ml/min	0.34 CFH = 160 ml/min

10. REPORTING RESULTS

~~10.1~~ Report the results of the quantification of the leak rate through the drop tube/drain valve assembly as indicated ~~Drop Tube/Drain Valve Assembly as shown~~ on Form 1. Districts may require the use of alternate forms, provided they include the same minimum parameters as identified on Form 1.

11. ALTERNATE PROCEDURES

~~11.1~~ This procedure shall be conducted as specified. Modifications to this test procedure shall not be used to determine compliance unless prior written approval has been obtained from the ~~CARB~~ Executive Officer, pursuant to Section 14 of ~~Certification Procedure~~ CP-201 (Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities).

Form 1 [Form is to be replaced with new Form 1]

Field Data Sheet

Pressure Integrity Of Drop Tube/Drain Valve Assembly

Facility:	Test Date:	Tester(s):
Address:	City:	Zip Code:
Phase I System Type:	Phase II System Type:	
Date of Last Flowmeter Calibration:	Date of Last Pressure Device Calibration:	

Test Results

Product Grade	Nitrogen Flowrate (CFH)	Pressure (inches H_20)	Make/Model Spill Containment Bucket	Make/Model Rotatable Product Adapter	Make/Model Rotatable Vapor Adapter

Comments:

TP-201.1C Form 1 [New Form 1]
Drop Tube/Drain Valve Assembly Data Sheet

Facility:	Test Company:	Test Date:
Address:	Test Personnel:	
City:	State, Zip Code	
Overfill Prevention Make & Model:	Spill Container Make & Model:	
Date of Last Flow Meter Calibration:	Date of Last Pressure Gauge Calibration:	

Test Results

Device Type & Product Grade	Time to Pressurize	30-Second Flow rate (CFH)	30-Second Pressure (in. H_2O)

Comments: